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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/557,961	04/25/2000	Kunihiro Takatani	245402001600	8878

25227 7590 05/19/2003

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EXAMINER

KANG, DONGHEE

ART UNIT	PAPER NUMBER
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2811

DATE MAILED: 05/19/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/557,961

Applicant(s)

TAKATANI, KUNIHIRO

Examiner

Donghee Kang

Art Unit

2811

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 06 March 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-3, 5, 8-10, 12 and 15-18 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-3, 5, 8-10, 12 and 15-18 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s) _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

DETAILED ACTION

Acknowledgment

1. Applicant's Amendment and Response to Paper No.19 have been entered and made of Record. Claims 4, 6-7, 11 & 13-14 are cancelled and new claims 15-18 are added. Thus claims 1-3, 5, 8-10, 12 & 15-18 are pending in this application.

Claim Objections

2. Claim **8** is objected to because of the following informalities: Mark version shows that the phrase "said second electrode layer comprising Ni but not in clean version. Clean version should have - -said second electrode layer comprising Ni--. Appropriate correction is required.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims **1-3, 5 & 15-18** are rejected under 35 U.S.C. 103(a) as being unpatentable over Okazaki (US 5,990,500) in view of Teraguchi (US 6,222,204).

Regarding claims **1 & 15**, Okazaki teaches an electrode structure on a p-type III group nitride semiconductor layer, comprising first, second and third electrode layers successively stacked on said semiconductor layer (*Col.3, lines 37-49 & Col.8, lines 56-58*),

said first electrode layer including titanium (Ti), said second electrode layer including palladium (Pd), and said third electrode layer including gold (Au). Okazaki does not explicitly teach the first electrode layer including at least one selected from a first metal group consisting of Hf, Zr, Nb, Ta and Sc.

However, Teraguchi teaches the first electrode layer formed on p-type III group nitride semiconductor layer including at least one selected from a first metal group consisting of Sc, Ti, Nb, La and Ta (Col.4, lines 39-43 & Col.5, lines 35-38) and the second electrode layer formed on the first electrode layer including Pd (Col.4, lines 44-50 & Col.5, lines 35-38). In Teraguchi's electrode structure, metal nitride (TiN, NbN....) is generated by the chemical reaction between the first electrode and nitrogen existing in the GaN layer. The metal nitride layer shows an extremely small contact resistance at the interface between the semiconductor layer and the electrode layer, thereby obtaining an ideal ohmic contact for p-type III group nitride semiconductor layer. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the titanium (ti) of Okazaki with Nb or Sc as taught by Teraguchi, since Nb or Sc can produce metal nitride layer by the chemical reaction with nitrogen existing in the GaN layer so as to provide an ideal ohmic contact for p-type III group nitride semiconductor layer.

Regarding claims **2 & 16**, Okazaki teaches the first electrode layer having a thickness in a range from 1 to 500 nm.

Regarding claims **3 & 17**, Okazaki teaches the second electrode layer having a thickness of 10 nm or less which is in the claimed ranges.

Regarding claims **5 & 18**, Okazaki does not teach the first layer including a nitride of a metal included in said first metal group and also including a compound of Ga and a metal included in said second metal group. Teraguchi teaches the first metal electrode layer including a nitride of a metal included in said first metal group but do not teach also including a compound of Ga and a metal included in said second metal. However, this feature is inherent because the Teraguchi's metal electrode structure is also treated by thermal process (Col.6, lines 5-17) and the electrode structure & material of Teraguchi is identical to the claimed electrode structure & material.

5. Claims **8-10 & 12** are rejected under 35 U.S.C. 103(a) as being unpatentable over Okazaki (US 5,990,500) in view of Admitted Prior Art (Fig.7).

Regarding claim **8**, Okazaki teaches an electrode structure on a p-type III group nitride semiconductor layer, comprising first, second and third electrode layers successively stacked on said semiconductor layer (Col.2, lines 47-65 & Fig.1B), said first electrode layer including titanium (Ti), said second electrode layer comprising nickel (Ni), and said third electrode including cobalt (Co). Okazaki does not teach the third electrode layer comprising gold (Au).

However, it is acknowledge that gold (Au) layer stacked on nickel electrode reduces the resistance of the electrodes and facilitates wire bonding and also taught by APA forming gold (Au), used as a material for surface electrode layer, on the nickel. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute cobalt (Co) of Okazaki with gold (Au) as taught by

APA, since gold (Au) layer reduces the resistance of the electrodes and facilitates wire bonding.

Regarding claim **9**, Okazaki teaches the first electrode layer having a thickness in a range from 1 to 500 nm (Col.5, lines 4-12).

Regarding claim **10**, Okazaki teaches the second electrode layer having a thickness 5 nm which is in the claimed ranges.

Regarding claim **12**, although Okazaki does not expressly teach first electrode layer including a nitride of metal included in said first metal, and also includes a compound of Ga and a metal included in said second metal, this feature is inherent because the Okazaki's metal electrode structure is also treated by thermal process (Fig.5B) and the electrode structure & material of Okazaki is identical to the claimed electrode structure & material.

Conclusion

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Donghee Kang whose telephone number is 703-305-9147. The examiner can normally be reached on Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on 703-308-2772. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7722 for After Final communications.

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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

dhk
May 12, 2003

RECEIVED
MAY 12 2003
Steven Lake